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COORDINATION GUIDELINES FOR TIMBER HARVESTING IN GRIZZLY BEAR HABITAT

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Coordination Guidelines for Timber Harvesting in Grizzly Bear Habitat in Northwestern Montana

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I. Introduction

The grizzly bear, (*Ursus arctos horribilis*), is currently classified as a threatened species under the Endangered Species Act of 1973. Section 7 of the Act states that: "All Federal departments and agencies shall carry out programs for the conservation of endangered species and threatened species and take such action necessary to insure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of such endangered species and threatened species or result in the destruction or modification of habitat of such species."

Timber harvesting is a dominant land management activity over a significant portion of the grizzlies' occupied habitat in northern Montana and Idaho. The primary objective of these guidelines is to provide grizzly bear/timber management coordination information for multiple use lands. Since approximately forty percent of occupied grizzly habitat is being managed as non-wilderness, it is essential land managers understand the relationships between grizzly bear, grizzly habitat, and the impacts of timber management (USFS, 1975).

The coordination guidelines are for use primarily in northwestern Montana and northern Idaho (Figure 1). However, many of the concepts and habitat responses are valid in other parts of grizzly range. If applied elsewhere, they should be adapted under the direction of wildlife biologists familiar with grizzly habitat in the area.

II. Impacts of Timber Harvesting and Management on Grizzly Bears and Their Habitat

Grizzly habitat can be influenced by timber management in two primary ways. First, the arrangement and abundance of vegetation can be changed. These changes affect the quality and quantity of habitat used by grizzlies for food and cover. Changes may have either positive or negative effects on grizzly habitat.

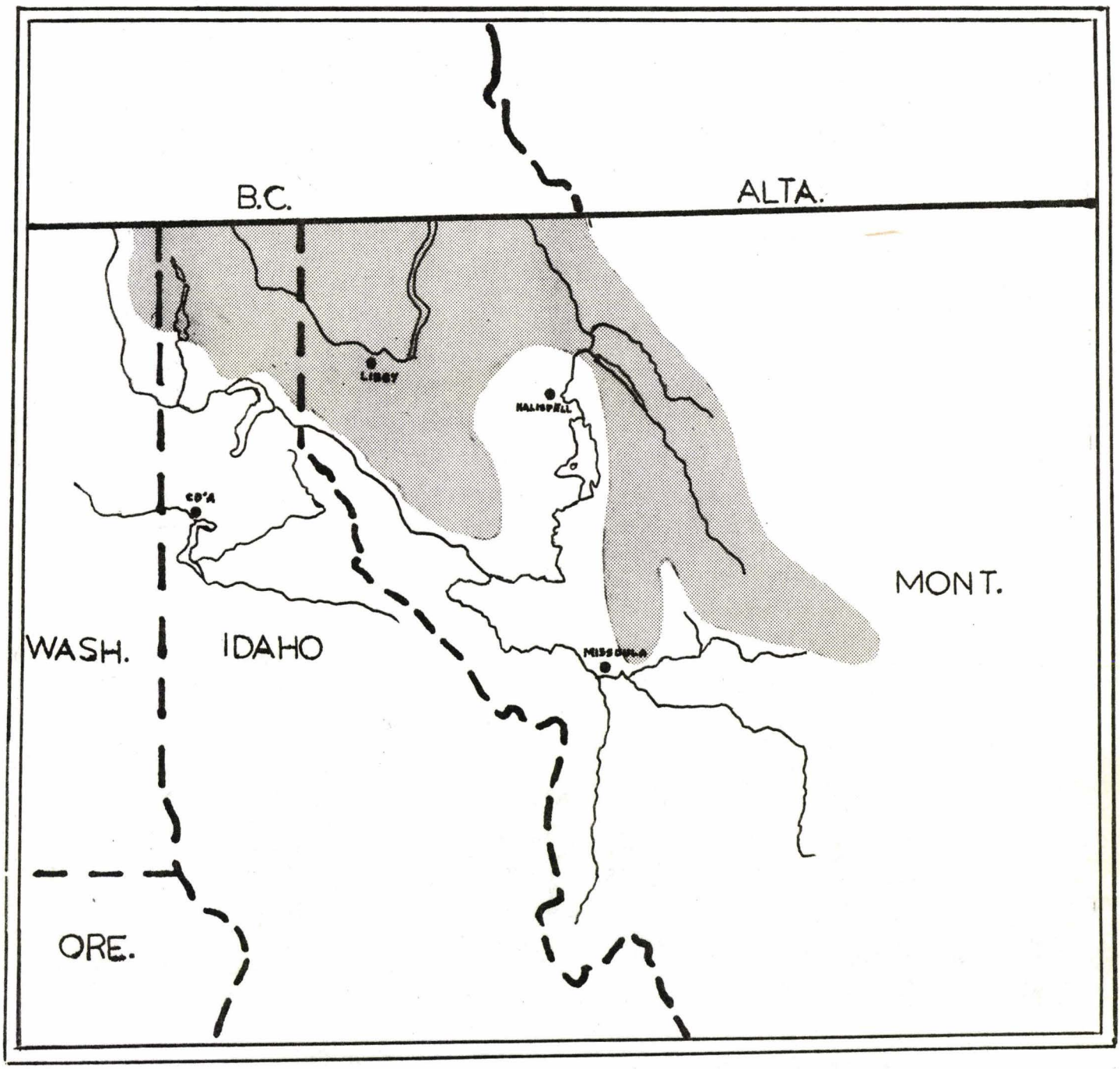

FIGURE 1. The coordination guidelines are for use primarily in northwestern Montana (west of the Continental Divide) and northern Idaho. If applied elsewhere, they should be adapted under the direction of a wildlife biologist familiar with grizzly habitat.

Denotes area where guidelines can be applied to lands managed for both timber and grizzly bear habitat.

Second, human activity in grizzly bear habitat can be changed. Road construction, logging activity, and the use patterns developed by the public after logging have a major effect on the quality of grizzly habitat (Erickson, 1976; Erickson, 1975; Craighead and Craighead, 1971; Craighead and Craighead, 1974; Mundy and Flook, 1973).

Vegetation changes (species composition, abundance, and vigor) created by timber management can be predicted and often coordinated to benefit the grizzly bear and its habitat. The ability to predict consequences of timber management activities in terms of vegetation changes is the key to coordinating timber management with grizzly needs.

III. Impacts of Timber Harvesting on Vegetation in Grizzly Bear Habitat

A. General

Timber harvesting and management can directly impact vegetation in grizzly bear habitat by:

1. Increasing food abundance
2. Decreasing food abundance
3. Decreasing cover
4. Increasing cover (not usually a consequence)

A secondary, but important, impact of timber harvesting is the increase in human activity during and after harvesting operations.

Grizzly foods can often be increased by removing or reducing overstory vegetation through harvesting, slashing, and/or burning. Treatment should be applied on a site and season specific basis to create a predictable increase in grizzly foods. In situations where food production is increased through forestry practices, there is a corresponding decrease in cover. This is a positive consequence if cover is not a limiting factor.

Decreases in grizzly food abundance or food production potential can result from:

1. Overscarification of logged sites.
2. Soil compaction on mesic or hydric sites.
3. Changes in surface or subsurface water movement and/or distribution.
4. Planting of conifers in sites where grizzly food production is significant, such as burns or unregenerated cutting units.

The consequence of decreasing grizzly bear food abundance is usually adverse on grizzly bear habitat quality.

Decreasing the amount of cover can have either positive, neutral, or negative effects on grizzly bear habitat quality. The land manager must first determine the amount of cover present, its distribution, and the amount of cover grizzlies need to effectively utilize the available habitat. If cover is determined to be limiting, in either its relative amount or distribution, timber harvesting will probably have negative effects. If cover is abundant, timber harvesting may have either no effects, or if food abundance and/or distribution is improved, the consequences will probably be positive. If human activity is not controlled after timber harvesting, and food production and/or distribution is improved, the impact may be negative on grizzlies due to the increased potential for human/bear confrontations.

There are few situations where cover will be increased by timber management activities. An example where it would be increased is in a burn or unregenerated cutting unit that was planted, resulting in a long term increase in cover. Burns are natural feeding areas for bears and are most attractive if maintained in seral successional stages.

Land managers can evaluate timber harvesting and management influences in grizzly habitat by assuming:

1. Increasing grizzly food abundance will provide an incentive for grizzlies to use the site.

2. Cover, in adequate proportions and interspersed with feeding sites, provides high quality grizzly habitat.

3. Decreasing grizzly food and cover over a significant area will reduce its value as grizzly habitat.

4. Disturbances to grizzlies resulting from human activities reduce an area's value as habitat.

B. Vegetation Management

Table I, set of tables for coordination by habitat type, non-forest component, etc., provides information basic to coordinating timber harvesting and management with grizzly bear habitat, including:

1. Timber Productivity

Timber productivity for forest habitat types was determined by data and information from Pfister, et. al. (1977) and Whitmer (personal communication). These sources were used to develop the Timber Management Plan for the Kootenai National Forest. Considerable variation exists within each habitat type. Some sites may display higher or lower productivity rates than indicated on Table I.

In the cases of nonforested habitat components, timber productivity was determined after consultation with the following people:

TABLE 1

TIMBER AND GRIZZLY BEAR CONSIDERATIONS IN GRIZZLY HABITAT COMPONENTS IN NORTHWESTERN MONTANA AND NORTHERN IDAHO, 1977

Forest Habitat Type Components		Timber Productivity	Timber Suitability	Grizzly Bear Food Productivity	Grizzly Bear Use Period	Important Food Items
PIAL/ABLA	*Pinus albicaulis/ Abies lasiocarpa*	L	L[A]	M	Summer, Fall	*Pinus albicaulis* *Lomatium spp.* *Erythronium grandiflorium* *Claytonia lanceolata*
ABLA/CACA	*Abies lasiocarpa/ Calamagrostis canadensis*	M	L	H	Spring, Summer, Fall	*Heracleum lanatum* *Angelica arguta* *Osmorhiza occidentalis* Mesic grasses
ABLA/LUHI/MEFE	*Abies lasiocarpa/ Luzula hitchcockii h.t., Menziesia ferruginea* phase	L	L[A]	H	Summer, Fall	*Heracleum lanatum* *Angelica arguta* *Osmorhiza occidentalis* Mesic grasses *Vaccinium globulare*
ABLA/LUHI/VASC	*Abies lasiocarpa/ Luzula hitchcockii h.t., Vaccinium scoparium* phase	L	L[A]	M	Late Summer, Fall	*Claytonia lanceolata* *Vaccinium globulare* *Vaccinium scoparium* *Pinus albicaulis*
ABLA/XETE/VASC	*Abies lasiocarpa/ Xerophyllum tenax h.t., Vaccinium scoparium* phase	L	L	M	Late Summer, Fall	*Vaccinium globulare* *Vaccinium scoparium*
ABLA/XETE/VAGL	*Abies lasiocarpa/ Xerophyllum tenax h.t., Vaccinium globulare* phase	M	L[B] M[C]	H	Mid-Summer, Early Fall	*Vaccinium globulare* *Vaccinium scoparium*
ABLA/LIBO/XETE	*Abies lasiocarpa/ Linnaea borealis h.t., Xerophyllum tenax* phase	M	L[B] M[C]	H	Mid-Summer through Fall	*Vaccinium globulare* *Shepherdia canadensis* *Arctostaphylos uva ursi*
ABLA/CLUN/MEFE	*Abies lasiocarpa/ Clintonia uniflora h.t., Menziesia ferruginea* phase	H	L[B] M[C]	Early successional stages - H Mid-Late successional stages - L	Late Summer, Early Fall	*Vaccinium globulare* *Sorbus scopulina*
ABLA/CLUN/XETE	*Abies lasiocarpa/ Clintonia uniflora h.t., Xerophyllum tenax* phase	M	L[B] M[C]	M	Mid-Summer, Early Fall	*Vaccinium globulare* *Sorbus scopulina* *Shepherdia canadensis*

Forest Habitat Type Components		Timber Productivity	Timber Suitability	Grizzly Bear Food Productivity	Grizzly Bear Use Period	Important Food Items
ABLA/CLUN/CLUN	*Abies lasiocarpa/ Clintonia uniflora h.t., Clintonia uniflora* phase	H	H	M	Spring, Summer, Fall	Mesic grasses *Osmorhiza occidentalis* *Erythronium grandiflorium* *Heracleum lanatum* *Angelica arguta*
ABLA/CLUN/ARNU	*Abies lasiocarpa/ Clintonia uniflora h.t., Aralia nudicaulis* phase	H	H	M	Spring, Summer Fall	*Vaccinium globulare* Mesic grasses and forbs *Cornus stolonifera*
ABLA/MEFE	*Abies lasiocarpa/ Menziesia ferruginea*	M	L M	L	Negligible	Few
PSME/VAGL	*Pseudotsuga menziesii/ Vaccinium globulare*	M	M	M	Fall	*Vaccinium globulare*
PSME/FIED PSME/CARU	*Pseudotsuga menziesii/ Festuca idahoensis* *Calamagrotis rubescens*	L	L[B]	M	Early Spring	Grass *Arctostaphylos uva ursi*
PSME/AGSP	*Pseudotsuga menziesii/ Agropyron spicatum*	L	L	M	Spring	Grass *Arctostaphylos uva ursi*
PICEA/CLUN PICEA/EQAR	*Picea/Clintonia uniflora* *Picea/Equisetum arvense*	H-M	H	M	Spring, Summer, Fall	*Sorbus scopulina* *Cornus stolonifera* Mesic grasses and forbs
Non-Forested Habitat Components						
Avalanche Chutes		L	L	H	Spring, Early Summer	Mesic grasses and forbs
Burns		M-L	Variable	H	Mid-Summer to Late Fall	Fruiting shrubs
Wet Meadows		L	L	H	Spring	Mesic grasses, sedges and forbs
Sidehill Parks		L	L	M	Spring	Grass
Low Gradient Streambottom		H	Variable	H	Spring, Summer, Fall	Mesic grasses and forbs Fruiting shrubs

A - Timberline Habitat Types
B - Over 35 percent slope is unregulated - regeneration difficulties
C - Under 35 percent slope

TABLE 1 (continued)

Forested Habitat Type	Components	Important Features	Acceptable Silvicultural Methods		Suggested Site Preparation Methods	Comments
PIAL/ABLA	*Pinus albicaulis/ Abies lasiocarpa*	Ridgetop	No treatment is recommended.		None	
ABLA/CACA	*Abies lasiocarpa/ Calamagrostis canadensis*	Low gradient stream-bottom, wet meadows.	salvage selection	Machinery should avoid mesic sites.	Lop, scatter. Machinery should avoid mesic sites.	Roads should avoid this habitat type.
ABLA/LUHI/MEFE	*Abies lasiocarpa/ Luzula hitchcockii h.t., Menziesia ferruginea* phase	Gently sloping topography, upper basins mesic sites.	No treatment is recommended.		None	
ABLA/LUHI/VASC	*Abies lasiocarpa/ Luzula hitchcockii h.t., Vaccinium scoparium* phase	Subalpine burns	No treatment is recommended.		None	Use basically for bulb and root foods when this habitat type occurs on shelf rock.
ABLA/XETE/VASC	*Abies lasiocarpa/ Xerophyllum tenax h.t., Vaccinium scorparium* phase	Burns	salvage selection		Broadcast burn, lop and scatter, or trample	Recommend maintaining 20% of the area in hiding cover, 15% of the area in thermal cover.
ABLA/XETE/VAGL	*Abies lasiocarpa/ Xerophyllum tenax h.t., Vaccinium globulare* phase	Burns	salvage group selection clearcut		Broadcast burn, strip scarify, if necessary, but do not exceed 35% of the site.	
ABLA/LIBO/XETE	*Abies lasiocarpa/ Linnaea borealis h.t., Xerophyllum tenax* phase	Seral stages are the most productive food sites	clearcut group selection thinning selection			
ABLA/CLUN/MEFE	*Abies lasiocarpa/ Clintonia uniflora h.t., Menziesia ferruginea* phase	Early successional stage openings without over scarification	clearcut group selection shelterwood selection thinning	Suspend one end of log to minimize scarification.		
ABLA/CLUN/XETE	*Abies lasiocarpa/ Clintonia uniflora h.t., Xerophyllum tenax* phase	Burns				
ABLA/CLUN/CLUN	*Abies lasiocarpa/ Clintonia uniflora h.t., Clintonia uniflora* phase	Mesic sites, streambottoms			Broadcast burn, protect mesic sites. Strip scarify, if necessary, but do not exceed 35% of the site.	
ABLA/CLUN/ARNU	*Abies lasiocarpa/ Clintonia uniflora h.t., Aralia nudicaulis* phase	Mesic sites, streambottoms	salvage group selection high risk	Suspend one end of the log.	Broadcast burn. Protect mesic sites from slash and machinery. Do not scarify.	

Forested Habitat Type Components	Important Features	Acceptable Silvicultural Methods	Suggested Site Preparation Methods	Comments
Wet Meadows		Should be protected from logging activities such as roads, skid trails, and machinery.	Recommend that meadows remain undisturbed.	Recommend leaving cover adjacent to meadows. Should have sight barrier between roads and meadows.
Sidehill Parks	South slopes	selection salvage high risk group selection	Lop and scatter.	Maintain 30% hiding/thermal cover interspersed and adjacent to openings.
Low Gradient Streambottom	Mesic sites	small clearcuts selection group selection high risk	Lop and scatter or burn. Machinery should avoid mesic sites.	Recommend locating roads above the riparian influence zone. Suspend one end of log to minimize scarification.

Forested Habitat Type Components		Important Features	Acceptable Silvicultural Methods		Suggested Site Preparation Methods	Comments
ABLA/MEFE	*Abies lasiocarpa/ Menziesia ferruginea*	Security habitat (living space), and mesic sites.	Not important consideration in grizzly bear management.		Not important consideration in grizzly bear management.	Recommend maintaining 20% of the area in hiding cover, 15% of the area in thermal cover.
PSME/VAGL	*Pseudotsuga menziesii/ Vaccinium globulare*	Burns. Exceptional berry production.	clearcut group selection shelterwood salvage		Broadcast or understory burn. Strip scarify if necessary.	↓
PSME/CARU	*Pseudotsuga menziesii/ Calamagrotis rubescens*	Sidehill parks	selection group selection salvage		Lop and scatter or pile and burn. Dozer use is usually compatible.	Preserve sidehill parks. Maintain 30% of the area as hiding and thermal cover.
PSME/AGSP	*Pseudotsuga menziesii/ Agropyron spicatum*	Sidehill parks	selection salvage		Lop and scatter or trample. Do not burn.	↓
PICEA/CLUN PICEA/EQAR	*Picea/Clintonia uniflora* *Picea/Equisetum arvense*	Streambottom	clearcut group selection shelterwood	Suspend one end of log to minimize scarification.	Prescribe burn where possible. Avoid mesic sites.	Recommend small openings interspersed in cover. Maintain 50% hiding/thermal cover.

Non-Forest Habitat Components			
Avalanche chutes	South slope-spring North slope-summer	No treatment is recommended.	Recommend avalanche chutes remain undisturbed.	Road construction should avoid crossing lower alluvial fans or changing patterns of avalanche chutes.
Burns	Important on south slopes.	salvage high risk	Burning	Small patches of timber within burns may serve as cover.

a. Forest Silviculturist - Bob Naumann
b. Timber Management Planner - Dave Whitmer
c. Soil Scientist - Lou Kuennen

2. Timber Suitability

Timber suitability was determined using information developed by the Kootenai National Forest Planning Team for land use planning. Criteria used to assess timber suitability include productivity, regeneration difficulty, slope, erosion potential, mass-wasting potential, and vegetative recovery. Of these, only productivity, regeneration difficulty, and vegetative recovery can be correlated directly to habitat type (Whitmer, personal communication).

3. Grizzly Use

Grizzly use of habitat types and nonforested habitat components has been described by Husby et. al. (1977), Mealey et. al. (1977), and Martinka (1972). Described use patterns were determined by (a) collecting grizzly scats, recording grizzly tracks and other grizzly sign within specific habitats, and (b) associating grizzly foods with habitat components and habitat types.

Figure 2 generalizes seasonal grizzly habitat use. Seasonal use was estimated by correlating grizzly food occurrance, grizzly use of food plants, and observed grizzly use of habitat types and nonforested components (Jonkel, 1976; Mealey et. al. 1977; Schallenberger, 1976). It is assumed grizzly bear will select feeding sites where food abundance is greatest, and where security habitat and cover is available.

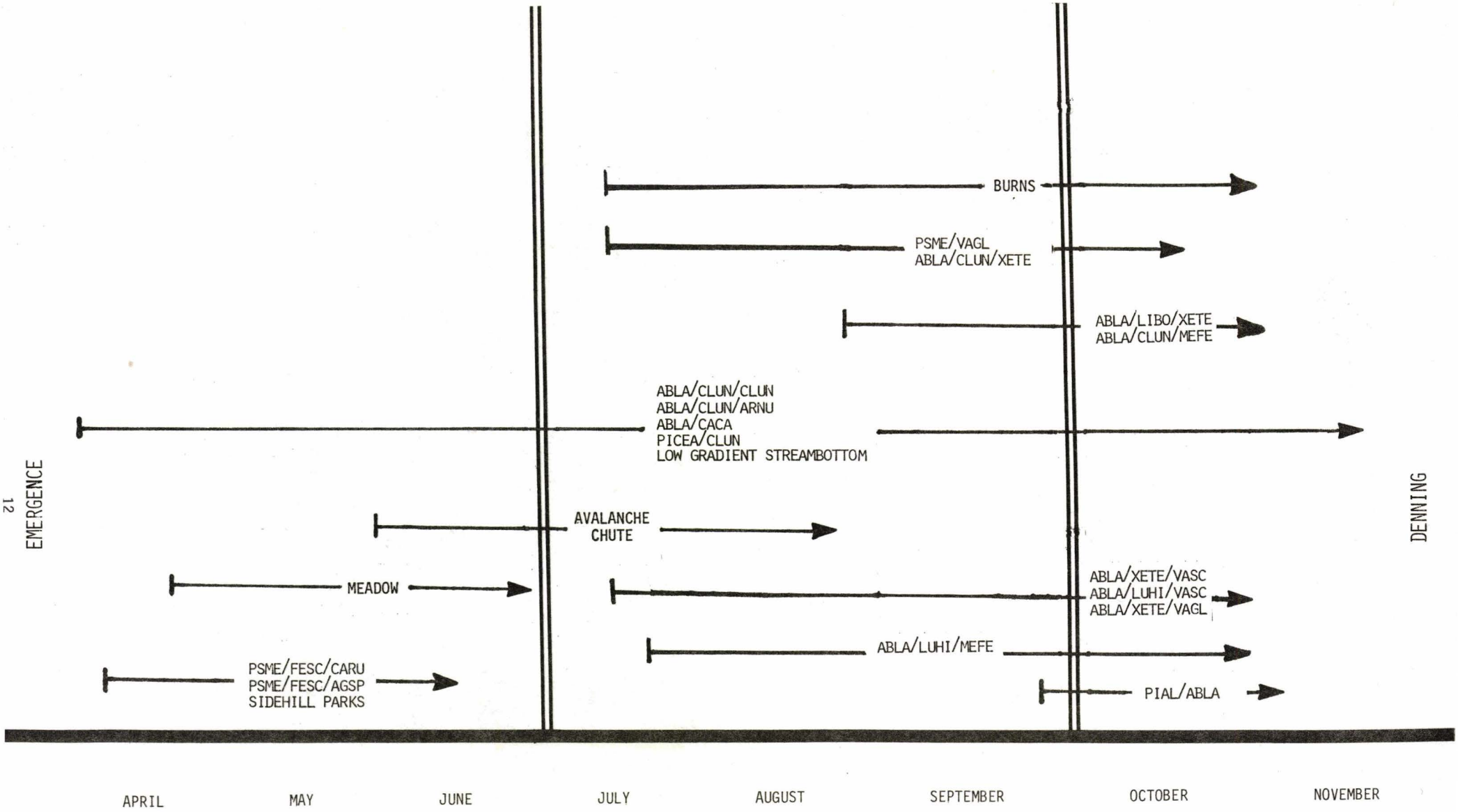

FIGURE 2. GRIZZLY BEAR SEASONAL HABITAT USE IN NORTHWESTERN MONTANA AND NORTHERN IDAHO, 1977.

Management Considerations:

Figure 2 indicates when grizzly bear are likely to use specific habitats. If possible, timber management activities should be planned when grizzly bear activity is likely to be low or absent. In cases where grizzly use is year-long, it is suggested a wildlife biologist make an on-site evaluation to determine if certain seasons have lower grizzly bear activity than others. A determination of the risks to grizzlies can be based on (a) occurrence and density (percent coverage) of grizzly foods, (b) vulnerability of grizzly estimated from the amount and juxtaposition of cover and security habitat, (c) relative amount of known or presumed grizzly use, and (d) magnitude of the proposed project.

Impacts on grizzlies should be assessed using the "Method for Determining Grizzly Bear Habitat Quality and Estimating Consequences of Impacts on Grizzly Habitat Quality" (USFS, 1977).

4. Grizzly Bear Foods

Table 2 summarizes preferred plant species selected by grizzlies in northwestern Montana (USFS, 1977):

Management Considerations:

Preservation or enhancement of sites producing grizzly foods should be a management objective in grizzly bear habitat. Land managers should have knowledge of specific plants utilized by grizzlies in each forest habitat type and nonforest habitat component. Most timber management activities can be coordinated to protect grizzly habitat. Land managers must recognize important grizzly

TABLE 2

GRIZZLY BEAR FOOD USE, FOOD SPECIES, AND HABITAT COMPONENTS WEST OF THE CONTINENTAL DIVIDE IN NORTHWESTERN MONTANA AND NORTHERN IDAHO AS THEY APPEARED IN 1975 AND 1976 (USFS, 1977)

Food Use[1]				
Food Items	Use	Importance Value %	Grizzly Food Species[2]	Grizzly Habitat Components[3]
Fruits and Berries		48.0	Trees	Non-forested Areas
	Vaccinium globulare 39.8		*Pinus albicaulis*	Avalanche Chutes
	Sorbus spp. 22.2		Shrubs	Stream Bottoms
	Shepherdia canadensis 11.9		*Amelanchier alnifolia*	Wet Meadows
	Arctostaphylos uva ursi 10.1		*Arctostaphylos uva ursi*	Burns
	Cornus stolonifera 5.7		*Cornus stolonifera*	Sidehill Parks
	Vaccinium scoparium 2.0		*Lonicera involucrata*	Ridgetops
	Rhamnus alnifolia 2.0		*Lonicera utahensis*	
	Disporum trachycarpum 1.5		*Ribes* spp.	Forested Habitat Types
	Rosa spp. 1.5		*Rosa* spp.	(Mesophytic herb understory)
Grass and Sedge	Stems and leaves	27.7	*Salix* spp.	AF/Caca (*Abies lasiocarpa/Calamagrostis canadensis*)
Umbelliferae	Stems and leaves	13.0	**Shepherdia canadensis*	AF/Luhi/Mefe (*Abies lasiocarpa/Luzula hitchcockii/Menziesia ferruginea*)
Equisetum arvense	Stems	4.0	**Sorbus* spp.	AF/Clun/Mefe (*Abies lasiocarpa/Clintonia uniflora/Menziesia ferruginea*)
Formicidae		2.0	**Vaccinium globulare*	AF/Clun/Arnu (*Abies lasiocarpa/Clintonia uniflora/Aralia nudicaulis*)
Roots	Umbelliferae and *Erythronium grandiflorum*	1.0	*Vaccinium scoparium*	S/Clun/Clun (*Picea/Clintonia uniflora/Clintonia uniflora*)
Trifolium spp.	Stems and leaves	1.0	*Vaccinium caespitosum*	WRC/Clun/Clun (*Thuja plicata/Clintonia uniflora/Clintonia uniflora*)
Taraxicum spp.	Stems and leaves	1.0	Forbs and Ferns	
Pinus albicaulis	Nuts	1.0	*Angelica* spp.	(Mesophytic fruiting shrub understory)
			Aralia naudicaulis	Af/Xete/Vagl (*Abies lasiocarpa/Xerophyllum tenax/Vaccinium globulare*)
Miscellaneous		1.3	*Astragalus robbinsii*	AF/Libo/Xete (*Abies lasiocarpa/Linnaea borealis/Xerophyllum tenax*)
			Castellija spp.	DF/Xete/Vagl (*Pseudotsuga menziesii/Xerophyllum tenax/Vaccinium globulare*)
			**Claytonia* spp.	AF/Clun/Xete (*Abies lasiocarpa/Clintonia uniflora/*
			Circium spp.	
			Disporum trachycarpum	
			Equisetum arvense	
			Erythronium grandiflorum	
			Frageria spp.	
			Fritillaria pudica	
			Hedysarum spp.	

Heracleum lanatum
Lomatium spp.
Ligusticum spp.
Osmorhiza occidentalis
Polygonium bistortoides
Polypodiaceae
Ranunculus spp.
Rumex spp.
Senecio triangularis
Smilacina spp.
Taraxicum spp.
Trifolium spp.
Veratrum veride

Graminoids
**Carex* spp.*
**Graminae*
Melica spectabilis

Mammal and Insect
Cervidae
Ursidae
Rodentia
Formicidae

Xerophyllum tenax)

AF/Xete/Vasc *(Abies lasiocarpa/Xerophyllum tenax/Vaccinium scoparium)*

(Xeric - Pine nuts and starchy-rooted forbs)

WBP/AF *(Pinus albicaulis/Abies lasiocarpa)*

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[1]From: Husby *et al.* (1977).

[2]From: Husby *et al.* (1977), Mealey *et al.* (1977), Martinka (1972), Tisch (1961).

[3]From: Mealey *et al.* (1977), Erickson (1976), Erickson (1975), Pfister *et al.* (1974), Martinka (1972), Jonkel and Cowan (1971), Tisch (1961).

*Foods of primary importance.

habitat and be knowledgeable as to how different treatments will impact the habitat to effectively coordinate projects.

The following are factors land managers should consider when planning timber management activities in grizzly bear habitat.

a. Grizzlies make primary food use of herbaceous plants on mesic and hydric (wet) sites such as wet meadows, seeps, low gradient stream bottoms, snow slides, and other poorly drained land features. Food plants can tolerate low intensity fires, light to moderate grazing, and periodic surface drought but generally cannot tolerate soil compaction, physical uprooting, or severe soil disturbances which result in drastic changes to the water table level.

   Examples of plants utilized by grizzlies which are sensitive to soil compaction, soil disturbances, and water table changes include *Erythronium grandiflorium*, *Claytonia lanceolata*, *Heracleum lanatum*, *Angelica spp.*, *Osmorhiza occidentalis*, *Veratrum veride*, and grasses and sedges associated with wet sites.

b. Plants utilized by grizzlies on sites which periodically burn include *Vaccinium globulare*, *Sorbus spp.*, *Arctostaphylos uria ursi*, and *Shepherdia canadensis*.

Burning is an excellent tool to perpetuate these species. Severe soil scarification, such as that often resulting from dozer piling, results in the removal of fruit producing perennial shrubs used by grizzlies (Jonkel 1976, Mealey et. al. 1977). *Vaccinium globulare* reestablishes a site through asexual, vegetative growth rather than through seeding. Revegetation of severely scarified

sites may take several decades or more (Miller, personal communication). On large units scarified homogeneously, *Vaccinium globulare* is essentially eliminated.

5. Suggested Methods for Silviculture, Slash Disposal and Site Preparation

An important objective of timber management activities in grizzly bear habitat should be the maintenance or enhancement of the sites' attractive habitat features. These features can be broadly classified as:

a. Food - fleshy fruits, succulent herbs, grasses, and sedges.

b. Cover - thermal and hiding.

c. Living space - home range of a viable population of grizzly bears. Living space must include adequate security habitat.

The consequences of timber management activities on food, cover, and living space can be positive, neutral, or adverse (USFS 1977, Mealey et. al. 1977, Jonkel 1975, 1976, and Erickson 1976, 1977). The success of a timber management program on grizzly bear can be evaluated by the extent to which the food, cover, living space and security habitat resources required by grizzlies are maintained or enhanced.

The silvicultural treatment used will directly impact both food and cover. Mealey et. al. (1977) and Jonkel (1976) found that selective cutting without subsequent site preparation produces the highest quality grizzly habitat in the ABLA/CLUN/MEFE habitat type. The second highest treatment was clearcutting without subsequent

site preparation. The lowest ranked treatment was clear-cutting with over fifty percent scarification. The ABLA/CLUN/MEFE habitat type appears to have a lower value as a grizzly food source when unlogged than when logged without site preparation and extensive soil scarification (Mealey et. al. 1977).

In the ABLA/CACA, ABLA/CLUN/ARNU, and PICEA/CLUN habitat types, succulent grasses and forbs are the primary grizzly foods. On some sites, fleshy fruits and root tubers are also important foods. The water table is often at or near the surface. In these situations, selection, group selection, and salvage harvesting under uneven age management is recommended followed by broadcast burning, or hand piling and spot burning. Site preparation or soil scarification is not recommended. Heavy machinery should avoid hydric sites to prevent compaction, changes in surface and subsurface water distribution, and mechanical damage to hydrophytic vegetation. If possible, one end of the log should be suspended during yarding.

In the ABLA/XETE, ABLA/CLUN/XETE, ABLA/LIBO, and PSME/VAGL habitat types, fruiting shrubs are the primary grizzly foods. *Vaccinium globulare* is of greatest importance. *Vaccinium globulare* occurrence can easily be reduced by prescribed burning where heat intensities are great enough to destroy rizomes or where dozer scarification mechanically uproots the rizomes. Conversely, light intensity prescribed burning accomplished when soil and duff moistures are high can lead to significant increases in the production of *Vaccinium globulare* (Miller 1977, Miller - personal communication).

Miller (1977) found that spring fires consistently produced the most huckleberry resprouts, but believed burning during other seasons could produce similar results if

fuel and duff moistures were high. During her research near Missoula, Montana, Miller did not observe any huckleberry seedlings, nor had any of the researchers she contacted. This led her to the conclusion that reliance on the reseeding of huckleberry after the rizomes have been destroyed is not a viable alternative to ensure the abundance or perpetuation of this species.

For this reason, and because of the relatively low importance value associated with dozer piled and scarified units, intensive machine scarification is not recommended in areas where *Vaccinium globulare* or other fleshy fruit producing perennials are important grizzly foods. Excessive scarification can result from dozer slash piling and from skidding logs without suspending the forward end of the log.

In the ABLA/CLUN/XETE, ABLA/XETE, ABLA/LIBO, and PSME/VAGL habitat types in grizzly bear habitat, land managers should select one of the following site preparation techniques (listed in order of preference):

- Broadcast burn when fuel volume is moderate to light and ground and duff moisture is adequate to protect rizomes.

- Strip scarify, but do not disturb over thirty percent of the site. Broadcast burn or jackpot burn only when ground and duff moisture is adequate to protect rizomes.

- No site preparation.

In the PSME/FESC, PSME/CARU and PSME/AGSP habitat types, the predominant grizzly food is grass. These habitat types are usually interspersed with sidehill parks and used by grizzlies shortly after their emergence from dens when grasses are green and succulent. Relatively low site

productivity and steep terrain may make timber harvesting a marginal opportunity in areas where grizzly use is evident. Often timber removal is light and the only necessary slash disposal or site preparation is lopping and scattering. If more site preparation or slash disposal is required, dozer piling and burning is viable on the PSME/CARU habitat type, provided continuous removal or disturbance of the top soil is avoided. Understory burning before spring green-up can improve grass production and nutrient quality and is recommended as a secondary treatment on these sites.

6. Cover

Grizzly cover use and requirements are poorly understood. It is known that grizzlies spend significant non-feeding periods in cover (Knight et. al., 1976; Craighead and Craighead, 1972). Often some food is available under a forest canopy.

The greatest use of cover can be expected when it is interspersed with grassland, herbland, or shrubland feeding sites (USFS, 1977). Two types of cover are important during the non-denning period: hiding cover and thermal cover (Thomas et. al. 1976; Black et. al., 1976).

a. Hiding cover provides an animal security. It is an insulation against predators, but is required in the absence of predators (man or animals) if full use of the habitat is to occur (Black et. al., 1976).

Hiding cover is defined as vegetation capable of hiding an animal at 200 feet (61 m) or less. The recommended minimum distance across hiding cover is three sight distances (600 feet or 183 m). Optimum size for hiding cover is 30-50 acres (12-20 ha).

b. Thermal cover aids in maintaining body temperature within tolerable limits. Thermal cover moderates extreme temperatures, being cooler during mid-day and warmer at night than surrounding openings. Animals use thermal cover to conserve energy during hot or cold periods (Black et. al., 1976).

Thermal cover is defined as coniferous trees 40 feet (12 m) or taller with a 70 percent canopy. Optimum size for thermal cover is 7-50 acres (3-20 ha).

c. Cover requirements

Cover interspersed with feeding sites is often considered high quality habitat. The amount of cover necessary may vary with the situation. Table I describes the minimum proportion of habitat which should be managed as hiding and thermal cover. The figures given should be used only in those situations where human disturbances are carefully controlled. In cases where human disturbances are not controlled, such as habitat adjacent to open roads, the percentage of habitat managed as cover should be increased.

It is recommended at least 30 percent of grizzly habitat be managed as cover. At least 210 acres per section should be managed as cover.

Timber harvesting is most beneficial as a grizzly bear habitat management tool in extensively forested terrain where natural or prescribed fire will not or cannot be used. In these situations, timber harvesting often can be used to increase food production or improve the cover and feeding site juxtaposition.

Timber harvesting should be carefully evaluated in situations where existing grizzly use is high or

where there is natural interspersion of cover and feeding sites. If either of these situations exist, it should serve as a red flag warning that timber harvesting may not be beneficial to grizzlies.

IV. Impacts of Increased Human Access on Grizzlies, Their Use of Habitat and Grizzly-Human Relations

Roads are the primary means by which man travels in nonwilderness grizzly bear habitat. Road construction into remote grizzly habitat encourages settlement, recreation use, recreation development, timber harvesting, mining, grazing, and other uses of the land by man. Extensive, uncontrolled road construction and access invariably leads to increased human activity and eventually increased human/grizzly conflicts (Jonkel, 1975). Human/grizzly conflicts nearly always result in adverse actions to grizzlies and in many situations have directly led to the extirpation of the grizzly from the ecosystem.

Grizzly bears require large areas where they are not vulnerable to man-caused mortality factors. Since grizzly bear home ranges tend to be large, the influence of man into key habitats (i.e., spring range) can result in the reduction or extirpation of bears over large areas. Undisturbed habitat is the most critical factor limiting increased grizzly numbers and range. Approximately fifty percent of man-caused grizzly mortality results from illegal shooting, removal of noxious bears, or accidents (Greer, 1973).

Road construction is normally part of timber harvesting in remote areas. Adverse impacts on grizzlies caused by increased road access include:

A. Easy access for humans into grizzly habitat.

B. Providing travel corridors for grizzlies into developments and areas where grizzlies are not tolerated.

C. Roads provide artificial food sources, if seeded with grass or clover, in zones that may concentrate humans and grizzlies. Such situations can make grizzlies and black bears (*Ursus americanus*) vulnerable to legal or illegal shooting.

D. Increased access tends to increase the amount of human use of adjacent backcountry. This can lead to direct and indirect influences on grizzlies including competition for space, legal and illegal hunting, settlement, increased camping and picnicking, and potential increases in the amount of garbage and other unnatural foods.

Recommended Road Management Measures

Road management is the most effective tool the land manager has to reduce the negative impacts of timber harvesting on grizzly bear. Road densities in grizzly habitat should be minimized (Jonkel 1975). Where timber types, terrain, and economics permit, helicopter logging may provide the maximum security to grizzlies because of the low densities of roads normally associated with it.

Recommendations for road management include:

A. All roads in grizzly bear habitat should be analyzed prior to harvesting, road construction, or major presale activities to determine when, where, or if road management is necessary, and to determine the impacts on grizzlies. Likely impacts on grizzlies should be assessed using the "Method for Determining Grizzly Bear Habitat Quality and Estimating Consequences of Impacts on Grizzly Habitat Quality" (USFS, 1977).

B. Roads and management activities within grizzly bear habitat should be restricted during periods of high grizzly use. These can be assumed to be those seasons when bear are most dependent upon the respective habitat types or adjacent non-forest habitat in and near sale areas (see Figure 2 and Table I).

The most critical periods are often spring green-up, berry fruiting season, and big game hunting season.

C. Roads in grizzly habitat should be closed after the necessary work has been completed.

D. Sales should be planned so that repeated entries over short periods are avoided.

E. Adequate security habitat should be available adjacent to active sale areas. Security habitat should consist of areas with good quality grizzly habitat which are roadless, or where roads are closed.

F. It is suggested a one-mile buffer zone separate areas where road access is permitted and grizzly habitat (Erickson 1976). Buffer zones can be larger or smaller if vegetation, topography, or other factors provide a more reasonable location.

Options for road closures are:

A. Permanent closures to motor vehicles for both public and administrative use.

B. Permanent closures to public use by motor vehicles, regulated administrative motor vehicle use (including timber harvesting).

C. Regulated administrative motor vehicle use (during critical periods), intermittent public motor vehicle use (during non-critical periods).

D. Intermittent public and administrative motor vehicle use.

E. No restrictions, open to use by all motor vehicle use.

The initiation of a viable road management plan is probably the most important factor influencing the long term impacts on grizzlies in habitat influenced by timber harvesting. In certain grizzly habitat such as the Cabinet Mountains and Yaak River divide, present road management practices are likely not sufficient to sustain long term grizzly bear populations. In such cases, positive vegetation manipulation alone will not improve the current status of the grizzly bear.

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ALPINE BURN, Wigwam Drainage, Whitefish Range.

Burns often provide high quality grizzly habitat, with berry producing shrubs providing the dominant habitat attraction. *Vaccinium globulare*, *Sorbus* spp., and *Shepherdia canadensis* are important grizzly foods used from midsummer to early fall. Burns important to grizzlies are often associated with the ABLA/XETE, PIAL/ABLA, and ABLA/LUHI habitat types.

Timber management practices in and adjacent to all burn areas within grizzly habitat should take into consideration cover requirements. Unburned patches of timber inside burns are particularly important for cover, as is timber along the perimeter.

CLOSE-UP OF MESIC GRASSES AND FORBS IN LOW GRADIENT STREAMBOTTOM.
Willow Creek, Cabinet Mountain Range.

Important food items include mesic grasses, sedges, and forbs such as *Heracleum lanatum*, *Angelica* spp., *Equisetum* spp., and *Veratrum veride*. Livestock often concentrate in low gradient streambottoms resulting in competition with bears. Roads located on the floodplain can significantly affect the use of adjacent openings. It is recommended roads be located upslope from the floodplain with at least two or more sight distances between roads and low gradient streambottom openings.

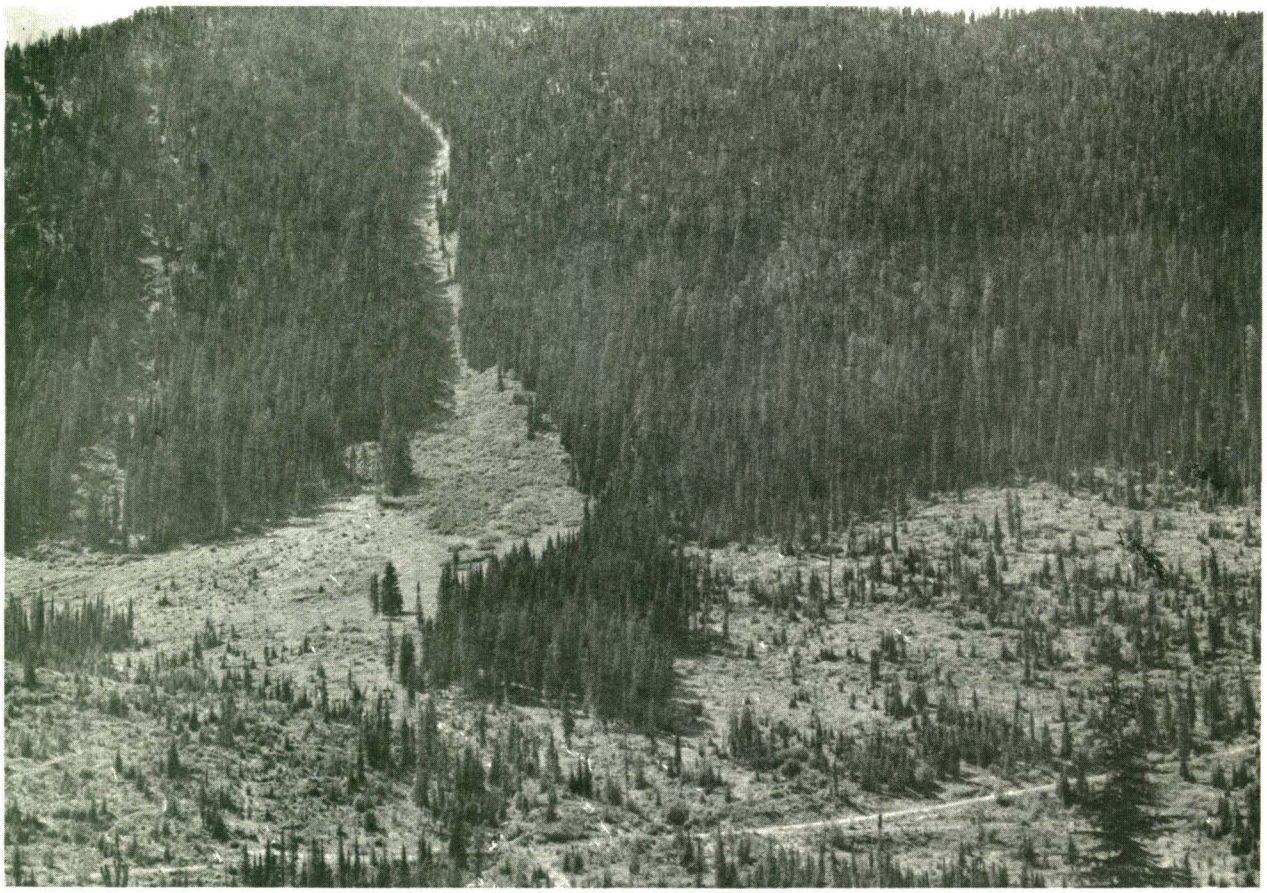
SIDEHILL PARKS. Pellick Ridge, Cabinet Mountain Range.

Sidehill parks are characteristically convex land features on steep south or west facing slopes. Grasses are the most important bear foods. They are often associated with Douglas-fir (PSME) habitat types. Sidehill Parks are usually used during early spring soon after emergence from denning.

Isolation and cover are important factors regulating use. Roads through or adjacent to sidehill parks should be closed during grizzly use, usually from April 1 through June 15. Cover should be maintained adjacent to sidehill parks for 2-3 sight distances (400 feet).

SUBALPINE RIDGETOP. Graves Creek, Whitefish Range.

Subalpine ridgetops are open, windswept sites above 5,000 feet elevation. They contain some grizzly foods such as grasses, whitebark pine nuts, berries, and starchy rooted forbs. Ridgetops often serve as travel corridors connecting important habitat components. Subalpine ridgetops are often associated with PIAL/ABLA, ABLA/XETE, and ABLA/LUHI habitat types.



The leave patch of timber between the avalanche chute and cutting unit in the lower, center portion of the photograph was used by grizzlies for hiding and thermal cover. A number of daybeds were found, as were abundant grizzly scats, and feeding evidence. The road in the lower picture has been closed to vehicular use except snowmobiles. Timber harvesting is evident in the fore and mid-ground. Grizzly foods within the logged area were most abundant in portions of the units where there was no site preparation. The predominant habitat type is ABLA/CLUN/MEFE.

Wigwam Creek, Whitefish Range.

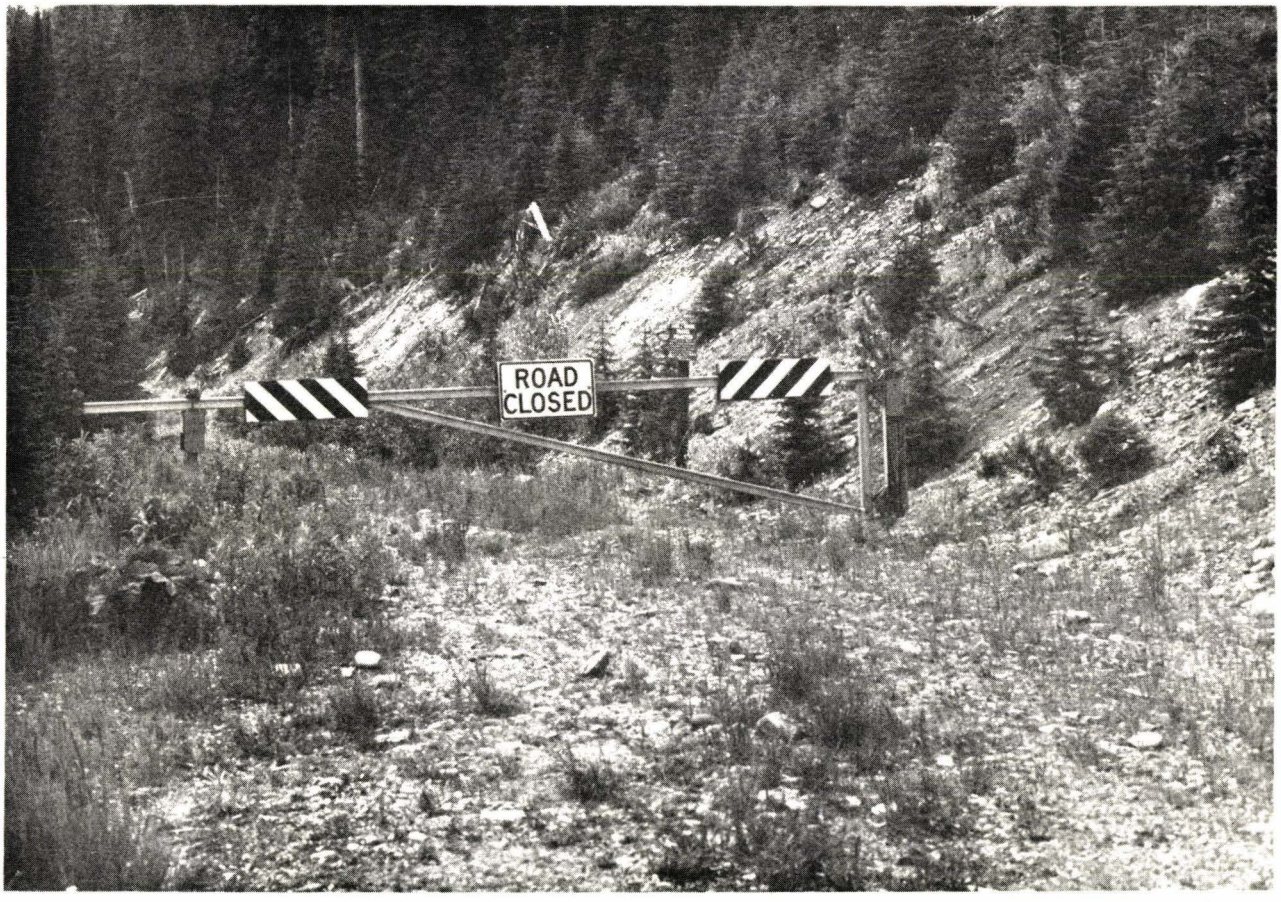
In the mid-ground portion of the photograph, timber harvesting was utilized to modify a continuous stand of conifers into a mosaic of openings and cover. Site preparation included broadcast burning and no treatment.

Wigwam Creek, Whitefish Range.

Timber harvesting along this portion of streambottom increased production of mesic grasses, sedges, and forbs utilized by grizzlies. The site was not scarified resulting in an increase of herbaceous material and a possible reduction of conifer stocking. Cover is available in the background. Present management direction would have given added protection to riparian vegetation and streamside cover.

Graves Creek, Whitefish Range.

Timber harvesting in situations where there is adequate natural interspersion of cover and openings will not benefit grizzlies. In the above situation, a winter range-sidehill park complex on Government Mountain in the Cabinet Mountain Range, timber harvesting adjacent to the natural openings would reduce the effectiveness of grizzly habitat. Also, a road across such an opening would result in a significant decrease in habitat use if available for vehicular travel during the spring.



ROAD CLOSURES. Graves Creek, Fortine Ranger District, Whitefish Range.

Road closures are the most effective method to minimize grizzly/human confrontations and are an essential element if timber harvesting and grizzlies are being managed together. Road closure options include seasonal, year-long, and administrative use only. Adjustment of timber sale programs may be necessary to ensure contiguous drainages are not open to disturbances simultaneously or that important drainages to grizzlies are not open to continuous disturbances due to a succession of sales or activities.

Road closures should include a sign designating when the closure is in effect and why the road is being managed. People seem to accept road closures more readily if they understand why use is restricted.

Graves Creek, Fortine Ranger District, Whitefish Range.